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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ZHAOBO MENG

Appeal 2017-003862
Application 12/878,607
Technology Center 2100

Before JUSTIN BUSCH, ALEX S. YAP, and JASON M. REPKO, *Administrative Patent Judges*.

REPKO, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1–9. Claims 10–27 have been canceled. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

THE INVENTION

Appellant's invention enhances seismic data by combining a dip-guide with full waveform inversion (FWI). *See* Abstract. In particular, FWI can produce models from seismic data with high-resolution detail. Spec ¶ 2. But FWI is computationally expensive. *Id.* ¶ 5. The invention calculates a dip-guide as a tensor field representing the underlying seismic data and uses the dip-guide in FWI. *Id.* ¶ 14. As a result, the invention reduces the computational cost and the dimension of the inversion. *Id.*

Claim 1 is reproduced below with our emphasis:

> 1. A non-transitory computer-readable storage medium having instructions stored therein, the instructions being executable by a processor to cause the processor to perform operations, the operations comprising:
>
> a) obtaining an image from seismic data;
>
> b) calculating a misfit gradient, ∇E_m;
>
> c) obtaining a dip-guided tensor field, Φ, from the seismic data, wherein the dip-guided tensor correlates with the misfit gradient and wherein interpolation by the dip-guided tensor field is guided by dip information obtained from the image;
>
> d) identifying measurement points, $\mathbf{x}$, at changes in the image-guided interpolated tensor field;
>
> e) calculating the misfit gradient with respect to the measurement points, ∇E_x;
>
> f) *developing a full waveform inversion model represented by* $\mathbf{m}_{DG} = \mathbf{\Phi x}$, *using the dip-guided tensor field, wherein the dip-guided tensor field is used to condition the full waveform inversion,* wherein convergence of the full waveform inversion is performed using function $\min_x E = \frac{1}{2}\|\mathbf{d_0} - \mathbf{F(\Phi x)}\|_2^2$ where E is error across the function, $\mathbf{d_0}$ is measured data and $\mathbf{F(\Phi x)}$ is a data model.

THE REJECTIONS

The Examiner relies on the following as evidence:

Krebs	US 5,696,735	Dec. 9, 1997
West et al.	US 2002/0183932 A1	Dec. 5, 2002
Sirgue et al.	US 2007/0282535 A1	Dec. 6, 2007

Claims 1–6 and 8 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Applicant's Admitted Prior Art ("AAPA"), West, and Sirgue. Ans. 4–8.[1]

Claims 7 and 9 stand rejected under 35 U.S.C. § 103(a) as unpatentable over AAPA, West, Sirgue, and Krebs. Ans. 9.

THE REJECTION OVER AAPA, WEST AND SIRGUE

Appellant argues that Sirgue lacks "developing a full waveform inversion model represented by $\mathbf{m}_{DG} = \mathbf{\Phi x}$, using the dip-guided tensor field, wherein the dip-guided tensor field is used to condition the full waveform inversion." Br. 3. According to Appellant, "Sirgue does not explicitly describe the $\mathbf{m}_{DG} = \mathbf{\Phi x}$ relationship which defines x." *Id.*

But the Examiner does not rely on Sirgue alone to teach this feature. Ans. 2. Rather, the Examiner relies on the combined teachings of the admitted prior art, West, and Sirgue. *Id.* Specifically, Sirgue teaches a full three-dimensional frequency domain waveform inversion on a three-dimensional data set. Sirgue ¶ 69. The Examiner relies on this disclosure in

[1] Throughout this opinion, we refer to (1) the Non-Final Rejection ("Non-Final Act.") mailed April 26, 2016, (2) the Appeal Brief ("Br.") filed September 26, 2016, and (3) the Examiner's Answer ("Ans.") mailed December 9, 2016.

support of the finding that Sirgue discloses a full-waveform inversion model. Ans. 2 (citing Sirgue ¶¶ 22–23, 51, and 69). The Examiner, however, finds that Sirgue's model is not represented by $\mathbf{m}_{DG} = \mathbf{\Phi x}$, like the model recited in claim 1. Ans. 2.

In concluding that claim 1 would have been obvious, the Examiner finds that West obtains the recited dip-guided tensor field, $\mathbf{\Phi}$. *Id.* at 3 (citing West ¶¶ 37, 59–60). Furthermore, the Examiner proposes performing the full waveform inversion using the expression taught in the admitted prior art.[2] Ans. 4 (citing Spec. ¶¶ 26, 27). That is, the Examiner finds that combining these teachings one of ordinary skill would have arrived at a full waveform inversion model represented by $\mathbf{m}_{DG} = \mathbf{\Phi x}$. *See* Ans. 2. The Examiner concludes that the combination of these teachings would have improved the accuracy of the resulting velocity model for analyzing seismic data. Non-Final Act. 7.

Appellant does not provide arguments against West, the admitted prior art, or their proposed combination with Sirgue. *See* Br. 3. Rather, Appellant's arguments in the Brief amount to an individual attack against Sirgue. *Id.* Because this argument does not take into account the Examiner's reliance on the above-discussed combination of teachings (Ans. 2–5), Appellant has not persuaded us of error in the rejection of independent claim 1 and claims 2–6, and 8, which are not separately argued. *See* Br. 3.

[2] Appellant does not provide a rebuttal to the Examiner's finding that the cited teachings are Appellant's admitted prior art. *See* Br. 3.

THE REMAINING OBVIOUSNESS REJECTIONS

Claims 7 and 9 depend from claim 1. In arguing against the rejection for claims 7 and 9, Appellant relies on the arguments presented for claim 1. *See* Br. 3. For the reasons discussed in connection with claim 1, we also sustain the rejection of claims 7 and 9.

DECISION

We affirm the Examiner's rejection of claim 1–9.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED